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ABSTRACT

A university information system should be designed to serve both the transaction processing needs and the information needs of management. This paper includes a chart illustrating the general flow of a system that serves both the transaction data and the a sample data base and how it could be used to generate the staff input parameters to CAMPUS. (AF)

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Project PRIME Report No. 7

A FACULTY ACTIVITY INFORMATION SUBSYSTEM and CAMPUS-MINNESOTA

by

HE002 634

June 1971

Project PRIME Research Coordinated by the
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GENERAL DESCRIPTION

A university information system should be designed to serve both the transaction processing needs and the information needs of management. The chart in Figure 1 on the following page illustrates the general flow of a system to serving both the transaction data systems and the planning systems.

The input of faculty data has been emphasized in this chart to coincide with the emphasis in this paper. A program could be developed to interface the data base that is routinely maintained by the transaction processing system with the CAMPUS planning model. The following sections describe a sample data base and how it could be used to generate the staff input parameters to CAMPUS.

FILE PROCESSING

All files have been structured for direct access processing. [See master file descriptions, p. 3-4.] History files can be stored on tape and read to disk when needed for processing. The structure of the files will depend on the hardware configuration available.

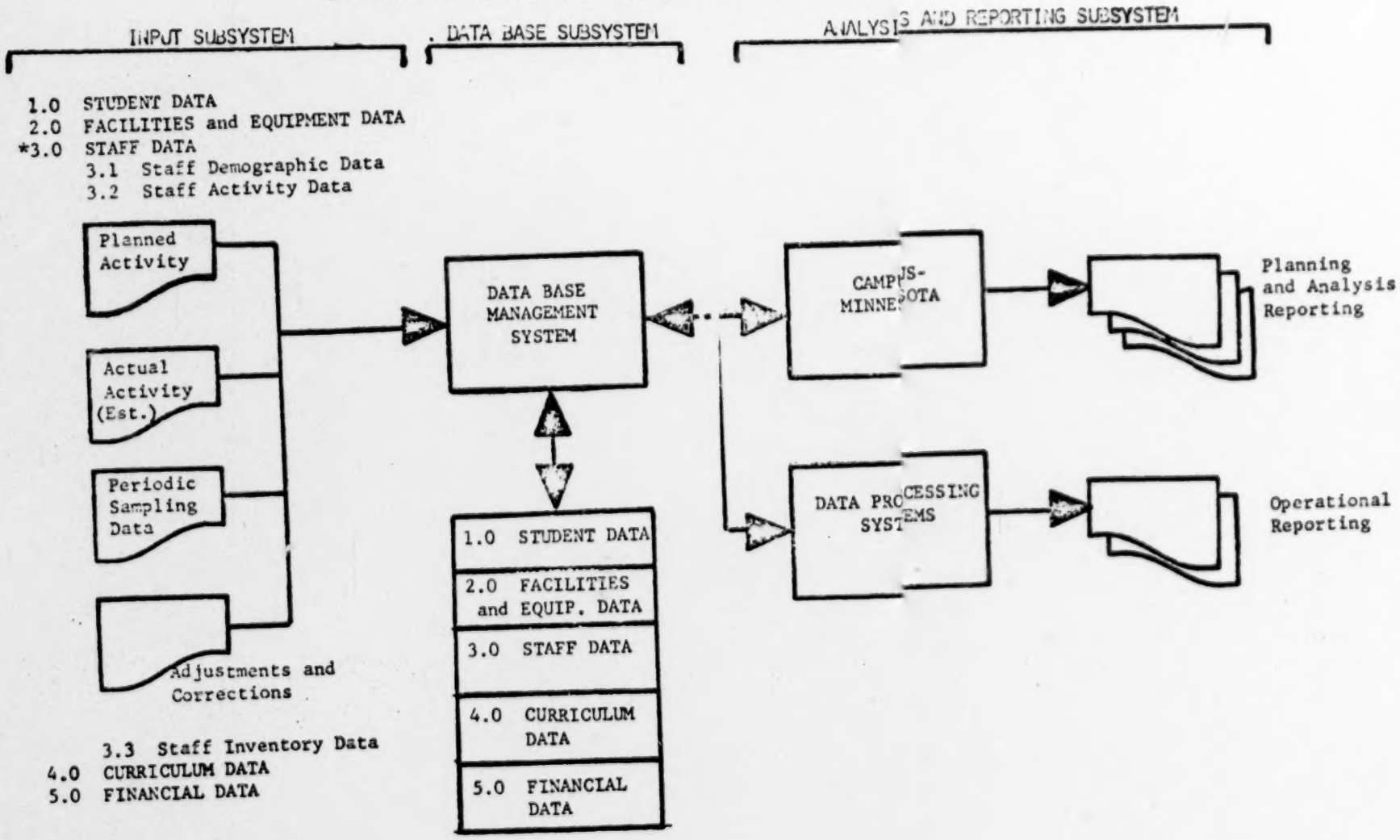
The instructor and activity files have been set up with direct addressing. This means the instructor number is the same as the address where it is stored on disk or some multiple of it. The same is true of the activity file. All the history files are trailer files to the activity and instructor files. They are stored in sequence by activity number of instructor number for a specific period such as a quarter or a semester. Consequently, if one is interested in analyzing the activities for a particular period, the file for that period is scanned. Through the use of home pointers each history file can be tied to the header information in the parent file. If one is interested in processing information by instructor or by activity, the master files containing this data are scanned, and the history for each master is obtained by traversing the history chain on each master.

STAFF INPUTS TO CAMPUS

The STAFF and XSTAFF inputs are almost the same for 01, 02 and 03. STAFF is used to input characteristics common to all cost centers and XSTAFF is used to modify the characteristics for specific cost centers. The characteristics are rank, rank name, average salary, weekly staffing units, office space per staff at each rank, and number of staffing

FIGURE 1

CAMPUS-MINNESOTA AND A UNIVERSITY INFORMATION SYSTEM



*Staff data has been shown in more detail as an example

MASTER FILES

Instructor File (Direct on Instructor Number)

Instructor Number
Name
Social Security Number
Specialty Type (Hegis Code)
Department or Budget Number (May have multiple occurances)
Percent Assigned (May have multiple occurances)
Demographic Data (WICHE Data Elements)
Rank and Tenure History
History Chain
Department Chain
Alpha Chain

Instructor Activity History (Stored by Period in Instructor Sequence)

Salary
Activity Pointer (15)
Home Pointer (Instructor Number)
Next History Pointer

Activity File (Direct on Activity Number)

Activity Number
Activity Name
Department Number
Department Name
HEGIS Code
Level of the Course
Specialty type required
Resource Requirement
Credits
Contact Hours
Section Size Characteristics
Schedule Chain
History Chain
Department Chain

Activity History File (Stored by Period in Activity Sequence)

Sections
Students
Instructor Number
Other Contact Hours
Preparation Hours
Evaluation Hours
Home Pointer (Activity Number)
Next History Pointer

Non-Teaching Activity File (Direct on Activity Number)

Activity Number
Activity Name
Non-teaching Activity Code
Next History Pointer

Non-Teaching Activity History (Stored in Activity Sequence by Quarter)

Instructor Number
Hours
Budget Number
Output Measures
  Number of Addresses
  Number of Reports
  Number of Papers
  Article Pages
  Book Pages
Home Pointer (Activity Number)
Next History Pointer

Schedule File (Stored in Activity Sequence by Quarter)

Activity Number
Section
Day, Hour, Room (May have multiple occurances)
Instructor Number (May have multiple occurances)

Student File (Index Sequential)

Student ID Number
Demographic Data
History Chain
Alpha Chain

Student History File (Stored by Period in Sequence by Student ID)

Activity Number
Grade
Home Pointer
Next History Pointer

units credit (i.e., hours or half hours depending on the value of a unit) that are given for each contact hour of a specific type of activity. There can be five types of activities such as lecture, laboratory and independent study for which different values per contact hour are given.

Five different kinds of non-teaching duties can be modeled. Non-teaching duties such as administration, research, student service, and professional development can be specified by rank and based on a table of values that are driven by the model. The table is referred to as the NBASIS table. It holds values that are derived in the model as each cost center is processed [Figure 2 lists the variables carried in this table]. Consequently, advising time of faculty could be a function of the number of students affiliated with that cost center.

STAFF 04 inputs the academic support staff common to all cost centers. The data includes the name of the staff, the average salary per period, office space required per individual and the number of contact hours of availability per week. At the present time the STAFF 04 input is not very useful because one cannot tie non-academic staff with the activities.

STAFF 05 provides data on non-academic staff by cost center. Non-academic staff can include graders, secretaries and student help. The input specifies type of non-academic staff, average period salary, office space and regression parameters to derive the number of non-academic staff. Again, regression coefficients can be used in conjunction with the values that are stored as each cost center is processed. Consequently, non-academic staff may depend on the academic staff at a cost center or it may depend on the number of enrollees at a cost center.

XSTAFF 04 the initial inventory, the transition percentages, (how many stay in the same rank and how many are promoted) the hiring code (can this rank be hired), maximum and minimums that can be hired, and the distribution of faculty among ranks are all specified on the XSTAFF 04 input. All inputs are by rank and cost center.

XSTAFF 05 is used to supply policy parameters regarding optimization and staff updating frequency. The following options are available.

1. Minimize the number of staff, or minimize the total staff salaries.

2. Allocate staffing units to non-teaching duties, or allocate only the excess staffing units to non-teaching duties, or ignore non-teaching duties.

3. Do normal staff transitions, or zero out previous inventory of staff before each simulation period.

Staff update frequency is controlled by specifying the periods (Fall, Winter, Spring) to update staff.

FIGURE 2

BASIS TABLE

FUNCTIONAL BASIS FOR THE CALCULATION OF INDIRECT RESOURCES AT A COST CENTER

Code Number	Description
1.	Absolute - value 1.0
2.	Affiliated students
3.	Affiliated enrollees
4.	Enrollee load
5.	Aggregate affiliated students
6.	Aggregate affiliated enrollees
7.	Aggregate enrollee load
8.	Number of academic staff
9.	Number of academic support staff
10.	Number of non-academic staff
11.	Total staff at the cost center
12.	Aggregate number of academic staff
13.	Aggregate number of academic support staff
14.	Aggregate number of non-academic staff
15.	Aggregate total staff
16.	Number of affiliated programs
17.	Aggregate number of affiliated programs
18.	Classroom space
19.	Laboratory space
20.	Total space
21.	Aggregate classroom space
22.	Aggregate laboratory space
23.	Aggregate total space
24.	Operating costs
25.	Aggregate operating costs
26.	Number of directly affiliated cost centers
27.	Absolute - Value 0.1
28.	Absolute - Value 0.01
29.	Absolute - Value 10.0
30.	Absolute - Value 100.0
31.	Absolute - Value 1000.0
32.	Total academic staff salaries
33.	Total academic support staff salaries
34.	Total non-academic staff salaries
35.	Total full time academic staff hired
36.	Total staff salaries
37.	Aggregate academic staff salaries
38.	Aggregate academic support staff salaries
39.	Aggregate non-academic staff salaries
40.	Aggregate total salaries
41.	
42.	Affiliated students in 100's
43.	Affiliated enrollees in 100's
44.	Enrollee load in 100's
45.	Aggregate affiliated students in 100's
46.	Aggregate affiliated enrollees in 100's
47.	Aggregate enrollee load in 100's
48.	Number of stations in a room
49.	Number of square feet in a room

CREATING STAFF INPUTS

CREATING STAFF 01 AND XSTAFF 01

STAFF 01 would be generated through the use of a master skeleton file that would contain rank code, rank name, weekly staffing units and office space. Average salary would be obtained by scanning the current quarter history file on instructor.

CREATING STAFF 02 AND XSTAFF 02

The activity history file would be scanned to obtain the number of hours required on the average to teach an activity by type and by department. This information can be used to generate the hours of faculty time per contact hour used on the STAFF 02 inputs.

CREATING STAFF 03 AND XSTAFF 03

The non-teaching activity history file would be scanned to obtain summary data on the average hours spent per week by type of non-teaching activity. Factors for administration could be generated by making adjustments for the amount of staff assigned specifically to administrative tasks by scanning the instructor file for assignments.

CREATING XSTAFF 04

This input would be generated by obtaining the initial inventory from the instructor file. The hiring code, transition criteria and rank distribution would be maintained on a skeleton file which can be easily changed.

CREATING XSTAFF 05

The XSTAFF 05 input to the model would come completely from a skeleton file that would be changed only when one wanted to change staffing optimization policy.

STAFFING PROCESS IN CAMPUS

Initial inventory that comes in on XSTAFF 04 by rank is used to set up the inventory of staffing units in a cost center. Transitions (staff promotions and staff that leave) do not occur in the first simulation period. Otherwise transitions occur for every period an update of staff is required. When transitions occur, the percentage put in SAME (percentage that will stay in the same rank) on XSTAFF 04 is multiplied by the previous inventory to obtain the number of staff that stay in that same rank. This number is multiplied by the promotion

percentage to obtain the number of people in that rank that go the next higher rank. Finally the minimum hire parameter is added to the staff at that rank to obtain the total staff by rank after transitions. In summary:

$$TLRKSF(I) = (SFPVIV(I) * SAME(I)) + (SFPVIV(I + 1) * PROMOTE(I + 1)) + MINHIR(I)$$

where

TLRKSF = Total Staff
SFPVIV = Previous Inventory
SAME = Percentage staying the same
PROMOTE = Percentage promoted
MINHIR = Minimum to hire
I = Rank

When no transitions take place, TLRKSF(I) = SFPVIV(I). In the first simulation period TLRKSF(I) is set equal to the initial inventory that came in on the XSTAFF 04 input.

The total staff by rank (TLRKSF(I)) is multiplied by the number of staffing units each staff member is available per week in that cost center to derive total staffing units by rank. The number of staffing units of availability can vary by rank. The total staffing units are summed over ranks 1 and 2 and put into a part time supply (PARSUP). Ranks 1 and 2 are assumed by the model to be part time. Total staffing units summed over ranks 3-8 are put into full time supply (FULSUP). A summary of the results of this entire process is shown in Figure 3. Now that the supply of staffing units has been developed the model begins to assess demand. The first demand the model considers is non-teaching duties. If switch four (XSTAFF 05) has been set to "one" (staff up to non-teaching duties) then the model processes the STAFF and XSTAFF 03 input (non-teaching duties). Five different non-teaching duties can be specified. The non-teaching duties that were set up in experimenting with the model are compatible with the structure of categories used in the experiment done under Project PRIME [See project PRIME Report No.6.]. They are (1) Research and Scholarly Activity, (2) Public Service, (3) Student Support, (4) Department and Institutional Support and (5) Professional Development.

The model sums up the staffing units by type of non-teaching duty and by rank, using the regression parameters and the values in the NBASIS table. As an example, department and institutional services may be seventeen staffing units (half hour units) plus sixteen staffing units per staff member in the department. If the department had nine staff, the model would come up with a demand of 97 staffing units (46.5 hours) per week for administrative functions. The seventeen units allow for a department head who is quarter time, and an assumption is made that all staff are available 99 staffing units per week. See Figure 4 for an example of a cost center report showing the non-teaching duty demand.

Figure 3

ACADEMIC STAFF INVENTORY

BLOCK TIME RUN OF JAN 20 J97: 6 COST CTR MODEL

UNIV. OF MINN--: CH OF BUSINESS

COST CENTER REPORT 2.2
SESSION 1969/70
SIMULATION PERIOD 3

COST CENTER
LEVEL 1 DEPARTMENT
AFFILIATED WITH
NODE 5 ACCOUNTING
3 INSTRUCTION

ACADEMIC STAFF INVENTORY BY RANK

RANK	PREVIOUS INVENTORY	INVENTORY AFTER TRANSITION	NEW STAFF	TOTAL STAFF	AVERAGE SALARY ($)	TOTAL SALARY ($)	STAFFING UNITS PER RANK	TOTAL UNITS ACCUMULATED	COST PER STAFFING UNIT ($)
TEACHING ASSOC 1	2	0	2	2	1200	2.000	36	72	27
TEACH ASSOC 11	3	0	3	3	1200	4.000	36	108	37
PROFESSOR	2	2	0	2	7000	14.000	99	198	70
ASSOC PROFESSOR	5	5	0	5	5500	28.000	99	495	56
ASST PROFESSOR	3	3	0	3	4500	14.000	99	297	47
TOTAL	15	10	5	15	4200	62.000	78	1170	53

Figure 4

BREAKDOWN OF DIRECT ACTIVITY AND NON-ACTIVITY LOAD

COST CENTER
LEVEL 1 DEPARTMENT
NODE 5 ACCOUNTING
AFFILIATED WITH 3 INSTRUCTION

COST CENTER REPORT 2.3
SESSION 1969/70
SIMULATION PERIOD 3

DETAILED BREAKDOWN OF DIRECT ACTIVITY & NON-ACTIVITY LOAD AMONGST ACADEMIC STAFF

DIRECT ACTIVITY LOAD (TYPE OF ACTIVITY)	RANK REQD	STAFFING UNITS REQUIRED	COST PER STAFFING UNIT ($)	TOTAL COST ($)	TOTAL CONTACT HOURS	COST PER CONTACT HOUR ($)
LECTURE1	PART-TIME	180	33	6.000	60	99
LECTURE1	FULL-TIME	225	56	13.000	75	168
LECTURE3	FULL-TIME	45	56	3.000	45	56
TOTAL DIRECT ACTIVITY LOAD		450	49	22.000	180	123
NON-ACTIVITY LOAD						
ADMINISTRATION	GENERAL	230	56	13.000		
RESEARCH	GENERAL	240	56	13.000		
PUBLIC SERVICE	GENERAL	60	56	3.000		
PROF DEVELOP	GENERAL	60	56	3.000		
STUDENT SUPPORT	GENERAL	90	56	5.000		
TOTAL NON-ACTIVITY LOAD		680		37.000		
EXCESS STAFFING UNITS		40		2.000		
TOTAL FOR ALL STAFF LOADS		1170		62.000		

The other options for non-teaching duties are to (1) ignore non-teaching duties altogether (Switch 4 = 3, XSTAFF 05), or distribute only the excess staffing units to non-teaching duties after the allocation of staffing units to direct teaching activities (Switch 4 equals 2 on XSTAFF 05).

The second demand consideration, depending on the policy chosen in handling non-teaching duties, is the direct teaching duties. Contact hours are passed to the staff module from the activity (lecture, laboratory, independent study) and by type of staff requested such as full time, part time or general where general means either full time or part time. The staff module sums up the staffing units required for direct teaching duties by multiplying staffing units credit [by type of activity per contact hour (STAFF and XSTAFF 02)] by the number of contact hours in that type of activity.

Example:

Cost center "accounting" has a demand on activities that require

(a) 60 contact half hours of lecture 1 type activities for part time staff (instructors or Grad assistants)

(b) 75 contact half hours of lecture 1 type activities for full time staff (assistant professors, associate professors and full professors)

(c) 45 contact half hours of lecture 3 type activities for full time staff

If lecture 1 type activities are given 3 hours of credit to staff each contact hour and lecture 3 type activities are given 1 hour of credit for staffing each contact hour, then the total direct activity load generated in accounting would be:

(a) 60 * 3 = 180 part time half hours

(b) 75 * 3 = 225 full time half hours

(c) 45 * 1 = 45 full time half hours

Total part time	180 half hours
Total full time	270 half hours
Total	450 half hours

See Figure 4 for an example of a cost center report showing this output.

At this point in the processing the staff module has accumulated both the supply and the demand of staffing units at a cost center. If demand is greater than supply, a hiring situation is assesses.

Hiring is controlled by a number of parameters. Hiring will not take place if the hiring code is off (XSTAFF 04). Hiring at a specific rank will not take place if the maximum number that can be hired in a rank is reached for that rank. Hiring is also controlled by the minimum and maximum percentages desired in a rank. The rank with the greatest gap (minimum percent minus Actual percent) is hired. Otherwise a check is made to see whether one desires to minimize number of staff or minimize total staff salaries (XSTAFF 05, Switch 3). If it is desired to minimize total staff, the rank with the highest staffing units available per week that has room (i.e., actual percent distribution is below maximum percent specified) will be hired. If all ranks have the same availability of staffing units specified per staff, then the lowest rank is hired. If all ranks are equal or over the maximum percent, the rank with the smallest percent over the maximum is selected for hiring.

If it is desired to minimize total staff salaries then the rank hired is the one with the lowest cost per staffing unit where the actual percent distribution in ranks is less than the maximum specified.

Restraints on hiring force the model into considering other alternatives. If the model cannot hire full time (ranks 3-8), it will try to hire part time (ranks 1-2). If the model is restrained so that it cannot meet demand at all, then the excess demand is distributed to the supply rank by rank, weighted by the available staffing units per staff in each rank as a percentage of the minimum available staff units across all ranks.

After all demand is assessed, the staffing module goes on to calculate total salaries by rank, costs per staffing unit by rank, cost of non-teaching duties, cost of excess staffing units, cost of teaching duties by type of activity and total cost of teaching and non-teaching duties.

Project PRIME Reports

Report Number	Description	Author
1	Test Implementation of CAMPUS (A Computer Based Simulation Model) for Higher Education Administration and Planning in Minnesota, March 1970.	Andrew, Cordes Lorents
2	An Introduction to Project PRIME and CAMPUS-MINNESOTA, November 17, 1970.	Cordes
3	PPBS in Higher Education: An Annotated Bibliography, May 1971.	Cordes
4.	PPBS in Education: Concept, Operation, Status, and a School of Business Administration Example.	Cordes
5.	Program Costing with the CAMPUS Simulation Model, June 1971.	Cordes
6.	Faculty Activity Analysis and Planning Models in Higher Education, June 1971.	Lorents
7.	A Faculty Activity Information Subsystems and CAMPUS-MINNESOTA. June 1971.	Lorents
8.	Operational Overview of the CAMPUS Simulation Model, June 1971.	Cordes
9.	Using a Planning Model in Higher Education, (in progress).	Fisher
10.	Resource Analysis Models in Higher Education: a Synthesis (in progress).	Cordes
11.	Converting CAMPUS V to CAMPUS-MINNESOTA (in progress).	Davitt
12.	CAMPUS-MINNESOTA User Information Manual, June 1971.	Andrew
13.	Applying Input/Output Analysis and the EL FYD Model to Higher Education (in progress).	Cordes
14.	Mid-Year Progress Report, January 1971.	Andrew, Cordes, Lorents
15.	Case Studies of Resource Simulation in Education (A High School; A Junior College; A State College and two Schools of a Large University, (in progress).	
16.	Final Report of Project PRIME (in progress).	Andrew, Cordes, Lorents